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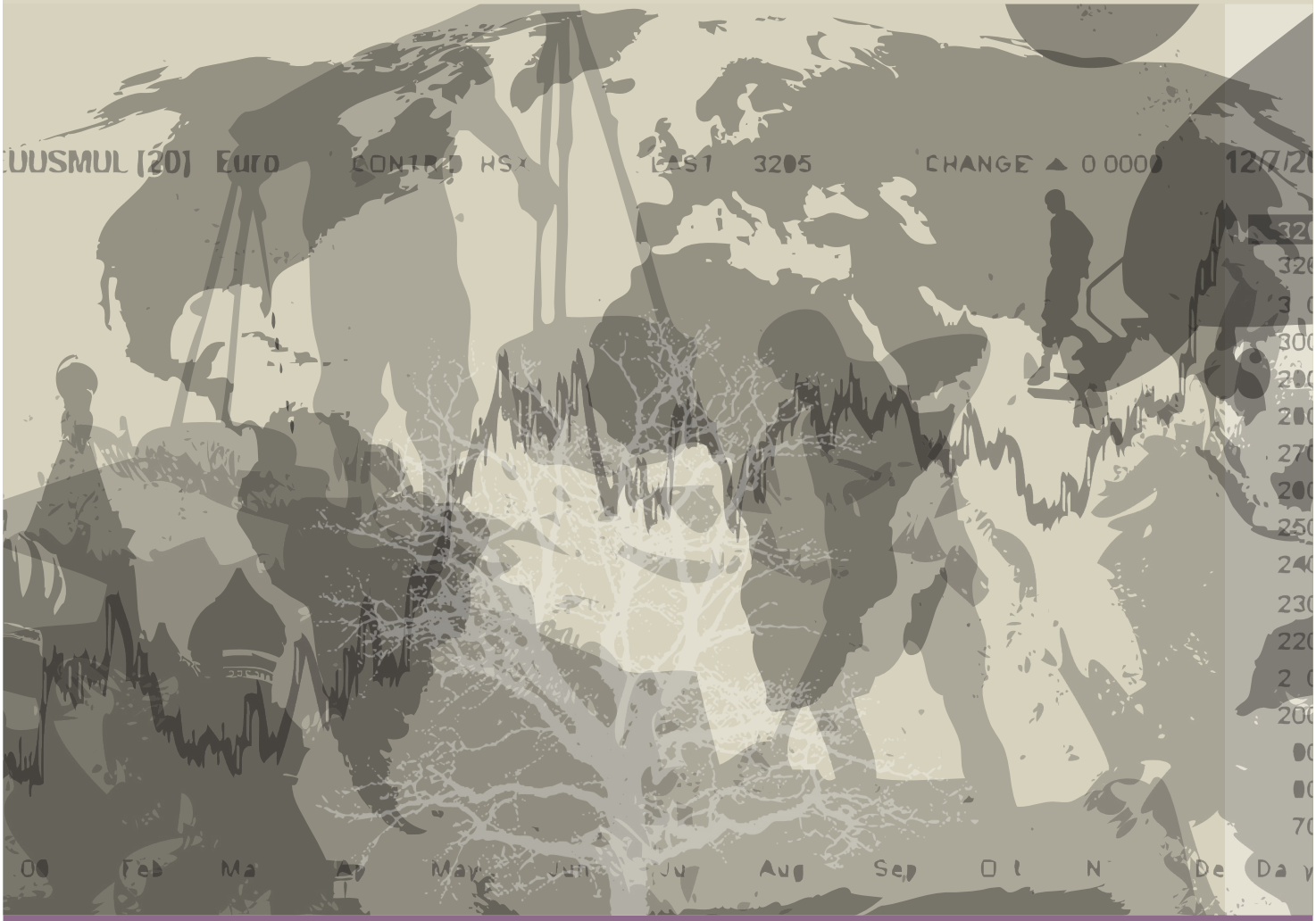
Oleksandr Shepotylo



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Effect of non-tariff measures on extensive and intensive margins of export in seafood trade

Oleksandr Shepotylo[1]

Abstract

We explore the effects of NTMs on extensive and intensive margins of export, focusing on seafood trade at various levels of aggregation. While SPS measures largely influence the variable trade costs, increasing extensive margins of export and reducing intensive margins, TBTs mostly increase fixed trade costs, reducing extensive margins of export and increasing intensive margins. STCs have larger effect on exports than SPS and TBT notifications both economically and statistically – STCs are mostly raised by exporters when their trade is considerably affected by regulations. Finally, there is substantial heterogeneity of response of exports to NTBs across product lines for more disaggregated data.

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Contents

Introduction

Non-tariff measures (NTM) have always been important elements of trade policy. With global reduction in traditional import tariffs, they are becoming relatively more important and frequent policy tools shaping the World trade. Number of tariff lines and share of trade covered by NTMs have increased between 1996 and 2004 (World Trade Report, 2012). NTMs come in different forms and address different policy concerns. While the consensus view on the tariff measures is in favor of reduction as the way to increase global social welfare, the view on NTMs is more nuanced. Increased public concerns about health and safety issues stimulate governments to regulate quality and safety of goods by means of sanitary and phytosanitary (SPS) measures and technical barriers to trade (TBT). As the World Trade Report (2012) points out, there is an upward trend in both SPS and TBT notifications. In particular, 2010 has shown both the maximum number of SPS and TBT notifications.

The effect of NTMs on trade is not straightforward. ***On the one hand***, it may impose additional costs on exporters. Here, it is important to distinguish the effect of NTMs on fixed costs of producing, from the effect on fixed costs of exporting, from the effect on variable trade costs. In the framework of the Melitz (2003) model, a non-discriminatory increase in the fixed cost of production would cut the least productive domestic firms from the market, which, among other things, would encourage entrance of new importers. Tougher technological or sanitary measures would tend to increase a threshold for the least productive domestic firms on the market, which would make more room for importing firms, resulting in a ***positive*** link between technical and sanitary requirements in foreign country and extensive margin of trade for exporters. The increase in fixed exporting costs would lead to the exit of the least productive exporters from the market, ***reducing*** extensive margins of trade. The increase in the variable trade costs would lead to reduction in export per firm, but also would cause the least productive exporters exit from the foreign market, redistributing exports towards more productive firms. The overall effect on export is ***ambiguous***. ***On the other hand***, higher technical and safety barriers may ***increase*** demand from the consumers who are concerned about quality and safety attributes of products. Firms that are able to overcome higher trade barriers would signal about quality and safety improvements, which would lead to expansion of trade at both extensive and intensive margins. **Therefore, it is hard to say *a priori* whether NTMs have a positive or negative effects on exports and its extensive and intensive margins.**

In this work we deal with this question empirically and explore the effect of NTBs on export, carefully modelling export decisions at extensive and intensive margins. We mostly build on work by Helpman, Melitz, and Rubinstein (2008), adding the panel dimension to their approach. We also address the issue of endogeneity of trade policy using the Hausman-Taylor approach of estimating the panel data model (Hausman and Taylor, 1981). We treat NTBs as ***endogenous*** vari-

ables that to a large extent depend on existing trade patterns. In particular, NTBs are more likely between countries that trade more intensively, that would generate a ***positive*** correlation between trade flows and NTMs.

We focus on exports of seafood – a category of products, where SPS and TBT are used frequently. We analyze the effect of NTMs on extensive and intensive margins of trade at various levels of aggregation. First, the main result of this study is differential effect of SPS and TBT measures. SPS measures largely increase extensive margins of export and reduce intensive margins, which is consistent with the increasing production fixed costs story. TBTs mostly increase fixed costs of exporting, reducing extensive margins of export and increasing intensive margins. Second, specific trade concerns (STC) have larger effect on exports than SPS and TBT notifications both economically and statistically – which is not surprising since STCs are mostly raised by exporters when their trade is considerably affected by regulations. Finally, there is substantial heterogeneity of response of exports to NTBs across product lines for higher disaggregated data.

The rest of the paper is structured as follows. Section 2 discusses literature on NTBs, focusing on seafood trade. Section 3 introduces data used in the study. Section 4 develops the methodology. Section 5 presents results. Section 6 concludes.

Literature

Literature on the effects of NTMs on export is not conclusive. Jaffee and Henson (2004) argue that NTMs can be barriers as well as catalysts to exports. For poor countries with lack of capacity to comply with the stringent regulations the NTM can increase trade costs to the levels that effectively shut down their exports. However, other countries may use this to their advantage and capture larger market share due to increased demand for safer and better quality products.

The empirical results are mixed. Most studies have found a negative effect of NTMs on trade. (i.e. Fontagne et al., 2005; Otsuki, Wilson, and Sewadeh, 2001; Peterson and Orden, 2005). Debaere (2010) has shown that the international differences in food-safety standards reduced Thai, Vietnamese, and Chinese shrimp exports to Europe and shifted them to the United States where standards were not as strict as in EU. However, more recent studies have found that NTMs can serve as catalysts of trade as well. Anders and Caswell (2009) investigated the effect of a Hazard Analysis Critical Control Points (HACCP) food safety standard for seafood imports. Results indicate that HACCP had a negative impact on the overall imports. However, a decomposition of the effect by exporting countries' level of development brought highly heterogeneous results. The effect for developing countries was negative, while the effect for developed countries was positive. Moreover, regardless of the level of development, leading seafood exporters generally experienced a positive HACCP effect. The results can be explained within a framework of the heterogeneous producer model. The HACCP has imposed additional costs on all importers, but it perhaps made a cost prohibitively high for the least productive importers, while allowing more productive importers to take the opportunity and expand their market share.

Our empirical approach is close to Crivelly and Groschl (2012) who have investigated the effect of the SPS measures on trade in agriculture and food using the methodology developed by Helpman, Melitz and Rubistein (2008). They found that conformity assessment related SPS measures have a negative impact on intensive margins of exports, while concerns related to product characteristics influence intensive margins of exports positively. The effect of SPS on the intensive margin of exports in their work is negative.

Our focus, however, is on seafood trade and on the effect of both SPS and TBT measures. As become clear from the result, the high degree of heterogeneity of the impact of NTBs on trade and differential effects of SPS and TBT measures requires studying the effect of NTMs at high level of disaggregation. We also introduce a time dimension to the analysis, while the HMR method was developed for a cross-section of bilateral trade[2].

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[2] See Shepotylo (2010) for more detailed discussion of the econometrics methodology.

Data

Export data

We define seafood products as all HS section 03 (Fish and crustaceans, mollusks and other aquatic invertebrates) product lines and HS four-digit 1603 (Extracts and juices of meat, fish or crustaceans, mollusks), 1604 (Prepared or preserved fish; caviar and caviar substitutes), and 1605 (Crustaceans, mollusks, prepared or preserved) product lines. Exports from country i to country j of a seafood product k at time t, exp_{ijkt}, measured in thousands of current US dollars are taken from the COMTRADE database. We limit the time span to 1996-2010. Trade data in COMTRADE is missing for a large group of countries prior to 1996, which would introduce a highly-nonlinear measurement error in our estimation procedure, which would not be able to discriminate missing observations from zero exports.

World export of seafood in 1996-2011 has been growing rapidly, averaging 9 percent per year. Figure 1 reports value of seafood trade for high income countries and low and middle income countries in 1996-2011. The seafood export form high income countries has been growing 5.8 percent on average, while the seafood export from the low and middle income countries has been growing 13.9 percent on average. Exports form the least developed countries has been even larger 26 percent. That allowed the export from the group of low and middle income countries to overcome the export from the group of high income countries in 2009.

Figure 1 Export of seafood in 1996-2011: High income vs. low and middle income countries

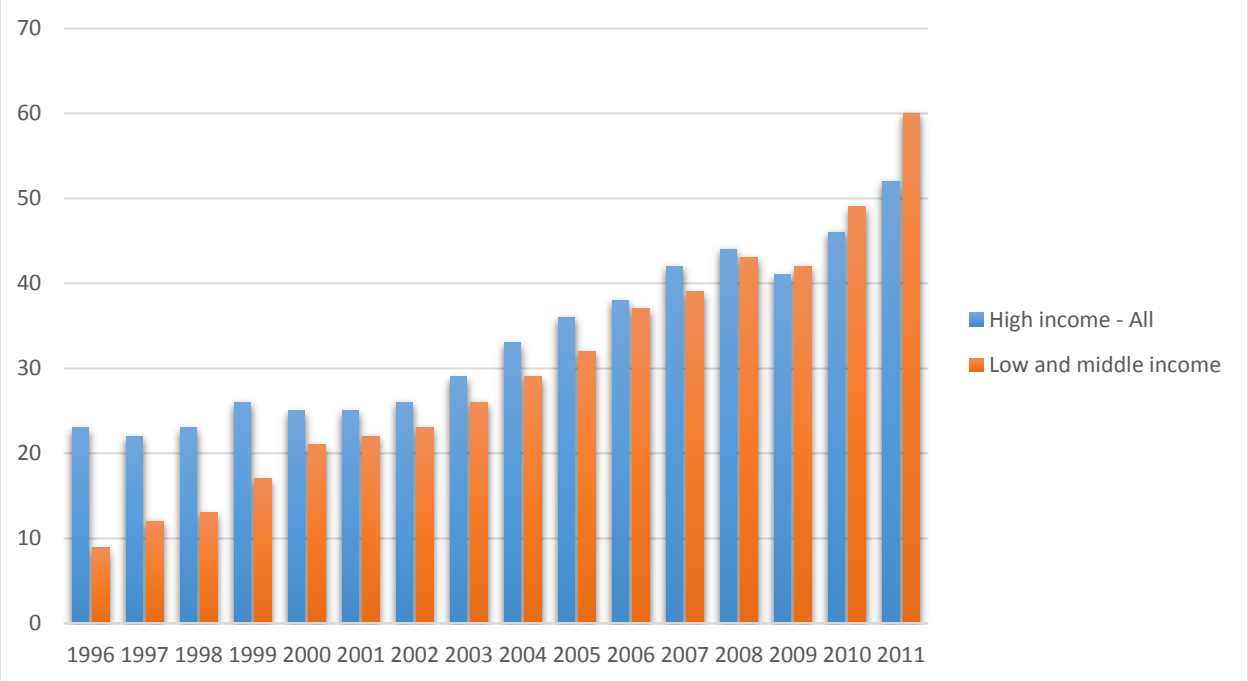

Table 1 lists all six-digit product lines, analyzed in this study, giving a brief description of each product category and value of cumulative export in 1996-2010. Over the investigated period, total export of seafood products has been equal to 0.9 trillion US dollars. The most exported products of seafood trade were product lines 030613 (frozen shrimps and prawns, 113.0 billion US dollars), 030420 (frozen fillets, 94.3 billion US dollars), and 030212 (fresh or chilled: Pacific salmon, Atlantic salmon, and Danube salmon, 45.6 billion US dollars).

NTB measures

NTB measures for this study come from the WTO Integrated Trade Intelligence Portal (I-TIP). It includes members' notifications as well as specific trade concerns about SPS measures.[3] Notifications are self-reported changes into the legislation affecting trade. Under the GATT rules countries are obliged to report the other WTO members about these changes. However, there is an issue with countries' compliance to report these measures, as has been discussed for instance at the Uruguay Round of the multilateral trade negotiations with the Decision on Notification Procedures signed by the WTO members. Reporting countries have no incentives to provide most accurate and up-to-date information on non-tariff measures and compliance systematically vary across countries. Countries that are affected by such decisions, on the other hand, have incentives to file a complaint. These complaints are recorded as STCs in the I-TIP. However, these concerns do not cover the whole universe of SPS and TBT measures. STCs are the NTB measures with the largest negative impact that introduces a negative selection bias into the estimation of the effect of NTBs on trade.

We use both notifications and STCs when estimating the effect of NTBs on seafood exports. The initial data includes 335 SPS and 78 TBT measures for seafood products notified to the WTO and 40 STCs raised by the WTO members from 1996 till 2010. Based on the information about the initiating and affected countries and about the products affected, we constructed SPS, TBT, and STC binary variables that take the value of 1 if an importing country j has a corresponding measure for product line k (HS six-digit level) against an exporting country i at time t and takes the value of 0 otherwise. When constructing the data, we included all possible combinations of bilateral trade flows, regardless of the fact whether the positive export took place.

After the NTBs were constructed at the HS six-digit level, we aggregated them to the HS 4-digit level according to the following rule

$$NTB_{ijh,t} = \frac{\sum_{k \in J_h} NTB_{ijk,t}}{J_h^*},$$

where h is HS four-digit product code, k is HS six-digit product code, J_h is a set that includes all six-digit product lines that belong to h, J_h^* is the number of six-digit product lines in J_h, and $NTB = \{SPS, TBT, STC\}$.

[3] I-TIP reports STCs about both SPS and TBT measures. However, there were no TBT STCs for seafood products during the investigated period.

Table 1 presents summary statistics for all measures of NTB in columns 4-6. SPS measures are the most widespread, affecting 15.4 percent of all possible bilateral exports. Live and fresh fish product categories are affected by SPS measures more frequently than frozen, semi-processed (salted, dried, or smoked), and cooked seafood products. TBT measures, on the other hand, affect 3.1 percent of bilateral exports and are more widespread for cooked and processed seafood products. STCs are the least frequent, affecting only 0.2 percent of bilateral exports. It is partially due to the fact that SPS and TBT notification are recorded in I-TIP as affecting all trading partners (meaning that if EU introduces an SPS measure it affects all of its trading partners in a non-discriminatory manner), while STC are raised by a specific exporting country against a specific importing country. It does not mean that an STC measure has no effect on other countries, but we do not have information on other potentially affected countries.

Table 1 Summary statistics of seafood exports and non-tariff barriers in 1996-2010

HS code (HS 1996)	Description	Export in 1996-2010, billion USD	Share of lines with		
			SPS	TBT	STC
0301	Live fish:	14.6	0.165	0.019	0.0027
030110	Ornamental fish	3.3	0.162	0.019	0.0027
030191	Trout	0.9	0.161	0.019	0.0027
030192	Eels	3.3	0.161	0.019	0.0027
030193	Carp	0.5	0.161	0.019	0.0027
030199	Other	6.6	0.161	0.019	0.0027
0302	Fish, fresh or chilled:	112.0	0.193	0.019	0.0029
030211	Trout	2.2	0.191	0.019	0.0027
030212	Pacific salmon, Atlantic salmon, and Danube salmon	45.6	0.192	0.019	0.0027
030219	Salmonaide: Other	1.8	0.191	0.019	0.0027
030221	Halibut	1.9	0.191	0.019	0.0027
030222	Plaice	1.1	0.191	0.019	0.0027
030223	Sole	3.2	0.191	0.019	0.0027
030229	Other	3.1	0.191	0.019	0.0027
030231	Albacore or longfinned tunas	0.7	0.191	0.019	0.0027
030232	Yellowfin tunas	1.9	0.191	0.019	0.0027
030233	Skipjack or stripe-bellied bonito	0.1	0.191	0.022	0.0027
030239	Tunas:-- Other	6.7	0.191	0.019	0.0027
030240	Herrings	1.4	0.192	0.019	0.0027
030250	Cod	4.7	0.191	0.019	0.0027
030261	Sardines, sardinella, brisling or sprats	1.0	0.191	0.022	0.0027
030262	Haddock	1.6	0.191	0.019	0.0027
030263	Coalfish	0.8	0.191	0.019	0.0027
030264	Mackerel	1.2	0.191	0.019	0.0027
030265	Dogfish and other sharks	0.5	0.191	0.019	0.0027
030266	Eels	0.3	0.191	0.019	0.0027
030269	Other fish:-- Other	31.7	0.193	0.019	0.0027
030270	Livers and roes	0.6	0.191	0.019	0.0027
0303	Fish, frozen:	136.0	0.143	0.028	0.0028

HS code (HS 1996)	Description	Export in 1996-2010, billion USD	Share of lines with		
			SPS	TBT	STC
030310	Pacific salmon	11.8	0.143	0.028	0.0026
030321	Trout	5.4	0.143	0.028	0.0026
030322	Atlantic salmon and Danube salmon	4.0	0.143	0.028	0.0026
030329	Other salmonidae:-- Other	2.4	0.143	0.028	0.0026
030331	Halibut	3.8	0.143	0.028	0.0026
030332	Plaice	0.6	0.143	0.028	0.0026
030333	Sole	1.5	0.143	0.028	0.0026
030339	Flat fish:-- Other	2.6	0.143	0.028	0.0026
030341	Albacore or longfinned tunas	1.7	0.143	0.028	0.0026
030342	Yellowfin tunas	5.6	0.143	0.028	0.0026
030343	Skipjack or strip-bellied bonito	3.7	0.143	0.028	0.0026
030349	Tunas:-- Other	5.9	0.143	0.028	0.0026
030350	Herrings	6.9	0.143	0.028	0.0026
030360	Cod	5.9	0.143	0.028	0.0026
030371	Sardines, sardinella, brisling or sprats	2.9	0.143	0.028	0.0026
030372	Haddock	1.0	0.143	0.028	0.0026
030373	Coalfish	0.7	0.143	0.028	0.0026
030374	Mackerel	12.1	0.143	0.028	0.0026
030375	Dogfish and other sharks	1.4	0.143	0.028	0.0026
030376	Eels	0.4	0.143	0.028	0.0026
030377	Sea bass	0.2	0.143	0.028	0.0026
030378	Hake	5.8	0.143	0.028	0.0026
030379	Other fish:-- Other	41.6	0.146	0.028	0.0026
030380	Livers and roes	8.5	0.143	0.028	0.0026
0304	Fish fillets and other fish meat:	147.0	0.147	0.018	0.0030
030410	Fresh or chilled	32.2	0.147	0.016	0.0026
030420	Frozen fillets	94.3	0.148	0.022	0.0026
030490	Other	20.3	0.147	0.016	0.0026
0305	Fish, dried, salted or in brine; smoked fish:	46.9	0.142	0.022	0.0029
030510	Flours, meals and pellets of fish	0.5	0.141	0.022	0.0026
030520	Livers and roes, dried, smoked, salted or in brine	2.8	0.146	0.022	0.0026
030530	Fish fillets, dried, salted or in brine, but not smoked	5.2	0.141	0.022	0.0026
030541	Smoked fish:-- Pacific salmon, Atlantic salmon	8.0	0.142	0.022	0.0026
030542	Smoked fish:-- Herrings	0.4	0.141	0.022	0.0026
030549	Smoked fish:-- Other	3.4	0.141	0.022	0.0026
030551	Dried fish:-- Cod	8.8	0.141	0.022	0.0026
030559	Dried fish:-- Other	7.3	0.141	0.022	0.0026
030561	Fish, salted:-- Herrings	0.6	0.141	0.022	0.0026
030562	Fish, salted:-- Cod	7.0	0.141	0.022	0.0026
030563	Fish, salted:-- Anchovies	0.8	0.141	0.022	0.0026
030569	Fish, salted:-- Other	2.0	0.141	0.022	0.0026
0306	Crustaceans:	172.0	0.159	0.024	0.0024
030611	Frozen :-- Rock lobster and other sea crawfish	7.0	0.158	0.024	0.0020
030612	Frozen :-- Lobsters	4.9	0.158	0.024	0.0020

HS code (HS 1996)	Description	Export in 1996-2010, billion USD	Share of lines with		
			SPS	TBT	STC
030613	Frozen :-- Shrimps and prawns	113.0	0.163	0.024	0.0027
030614	Frozen :-- Crabs	13.4	0.158	0.024	0.0020
030619	Frozen :-- Other	5.5	0.159	0.024	0.0020
030621	Not frozen :-- Rock lobster and other sea crawfish	4.8	0.158	0.024	0.0020
030622	Not frozen :-- Lobsters	10.0	0.158	0.024	0.0020
030623	Not frozen :-- Shrimps and prawns	6.4	0.158	0.024	0.0020
030624	Not frozen :-- Crabs	4.1	0.158	0.024	0.0020
030629	Not frozen :-- Other	3.1	0.159	0.024	0.0020
0307	Mollusks and aquatic invertebrates:	73.3	0.186	0.020	0.0026
030710	Oysters	2.4	0.187	0.019	0.0022
030721	Scallops:-- Live, fresh or chilled	2.6	0.185	0.019	0.0022
030729	Scallops:-- Other	7.4	0.185	0.019	0.0022
030731	Mussels:-- Live, fresh or chilled	3.1	0.185	0.019	0.0022
030739	Mussels:-- Other	2.3	0.185	0.020	0.0022
030741	Cuttle fish and squid:-- Live, fresh or chilled	3.3	0.183	0.019	0.0022
030749	Cuttle fish and squid:-- Other	21.5	0.184	0.019	0.0022
030751	Octopus:-- Live, fresh or chilled	1.1	0.183	0.019	0.0022
030759	Octopus:-- Other	9.6	0.183	0.019	0.0022
030760	Snails, other than sea snails	0.8	0.186	0.019	0.0022
030791	Other:-- Live, fresh or chilled	8.4	0.185	0.019	0.0022
030799	Other:-- Other	10.5	0.185	0.019	0.0022
160300	Extracts and juices of meat, fish or crustaceans, mollusks	1.7	0.108	0.076	0.0007
1604	Prepared or preserved fish; caviar and caviar substitutes:	110.0	0.106	0.083	0.0009
160411	Salmon	5.5	0.104	0.082	0.0008
160412	Herrings	5.0	0.104	0.082	0.0008
160413	Sardines, sardinella and brisling or sprats	8.9	0.109	0.085	0.0008
160414	Tunas, skipjack and bonito	34.6	0.108	0.084	0.0008
160415	Mackerel	3.5	0.105	0.082	0.0008
160416	Anchovies	1.7	0.104	0.082	0.0008
160419	Other	26.3	0.104	0.082	0.0008
160420	Other prepared or preserved fish	20.3	0.111	0.084	0.0008
160430	Caviar and caviar substitutes	4.3	0.104	0.082	0.0008
1605	Crustaceans, mollusks, prepared or preserved:	73.6	0.100	0.073	0.0007
160510	Crab	6.8	0.093	0.072	0.0006
160520	Shrimps and prawns	39.1	0.093	0.072	0.0006
160530	Lobster	2.0	0.093	0.072	0.0006
160540	Other crustaceans	3.2	0.093	0.072	0.0006
160590	Other	22.5	0.123	0.073	0.0006
All	Total Export and average NTB in 1996-2010	887.1	0.154	0.031	0.002

Notes: Export statistics is from the COMTRADE database. The share of lines with SPS, TBT, and STC (both SPS and NTB) measures is computed as the ratio of the number of bilateral export lines with a non-tariff measure within HS four-digit (HS six-digit) product category to the total number of theoretically possible bilateral lines within the corresponding product HS category.

Gravity model variables

The data on Gross Domestic Product (GDP) and GDP per capita in current US are from the World Development Indicators (WDI) 2012 published by the World Bank. Geographical characteristics and distance between countries are taken from the Centre D'Etudes Prospectives et D'Informations Internationales (CEPII, see Head, Mayer, and Ries, 2010 for detailed description of the data). Colony and contiguity dummy variables (whether one of the countries in the country-pair was ever a colony of the other country and whether countries share a common border) are used to control for pair-specific trade costs that are not directly related to distance. The same language dummy variable captures the effect of cultural similarities on trade. The dummy on common legal origin captures the compatibility of the legal systems of trading partners. Finally, the data on different dimensions of trading across borders, which are used for assessment of the impact of trade facilitation on exports – cost of shipping a container from exporting country, cost of shipping a container to importing country, and number of documents required to export and import – are computed as the period average, using the Doing Business database produced by the World Bank. The methodology of computing the trade facilitation variables is described in Djankov, Freund and Pham (2010).

Selection Variables

For identification of the first stage parameters, we chose three variables that enter the selection equation, but not the gravity equation. The common religion dummy controls for the pair-specific fixed costs related to adapting to cultural and linguistic barriers between two countries (culture, tastes, translation costs, advertising). The number of documents required to export from country i and the number of documents required to import to country j, collected by the Doing Business surveys since 2004, control for country-specific fixed costs related to regulatory quality in exporting and importing countries. Finally, we include log GDP per capita in the exporting country as a proxy for the factor unit cost parameter. All these variables are more likely related to a binary choice decision – to export or not – rather than influence intensive margins of trade.

Methodology

We take into account the mechanism of selection of firms into exporters and unobserved firm-level heterogeneity, present in the data, by applying the methodology developed by Helpman, Melitz, and Rubinstein (HMR, 2008). The presence of fixed costs that sometimes introduce prohibitively high trade barriers explains zero trade flows that play a dominating role in highly disaggregated data. The HMR two-stage procedure allows to dissect the effect of NTMs on export into two components – the effect of NTMs on value of trade between two countries (***intensive*** margins) and the effect of NTMs on the probability of positive export (***extensive*** margins). The latter is important because, as shown in the Melitz (2003) model, imposing a new trade barrier causes the changes in probability of trade.

The HMR estimation procedure is modified to take introduce the time dimension into the data and control for endogeneity of policy variables by the Hasuman-Taylor method (Hausman and Taylor, 1981). It allows for the decision of imposing an NTM to be endogenous, and it is instrumented by the time-invariant bilateral characteristics (i.e. geographical distance, contiguity, common legal system etc.), deviation of exogenous variables from their means, as well as period-average variable characteristics (level of economic development, market size).

We briefly outline the estimation procedure. Consider a monopolistic competition model with consumer preferences identical and homothetic across countries. Each country $i = 1, \dots, C$ has N_k^i firms that produce differentiated products in industries $k = 1, \dots, K$. Let c_{kl}^{ij} denote total consumption in country j of a good l that is produced by sector k in country i.

Consumers

A representative consumer located in country j has the utility function of the following form:

$$U^j = \sum_{k=1}^{K} \left(\int_{l \in B_k^j} c_{kl}^{j\,\frac{\sigma-1}{\sigma}} dl \right)^{\theta_k},$$

where $\sigma > 1$ is the elasticity of substitution across different products. θ_k is the expenditure share of industry k in total consumption. B_k^j is the set of industry k goods that are available for consumption in country j.

The optimal consumption derived from the optimization problem is

$$c_{kl}^{j} = \frac{\theta_k Y^j}{P_k^j}\left(\frac{p_{kl}^{j}}{P_k^j}\right)^{-\sigma},$$

where Y^j is the gross domestic product of country j that is equal to the total expenditures of country j. $P_k^j = \left(\int_{l\in B_k^l} (p_{kl}^j)^{1-\sigma} dl\right)^{\frac{1}{1-\sigma}}$ is the price index.

Producers

A country i firm produces one unit of output with $w^i a$ units of labor.[4] w^i is country specific. a is a firm-specific parameter with the cumulative distribution function $G_k(a)$ over support $[a_{kmin}, a_{kmax}]$. Each firm is a monopolist over the production of a distinct good but is small relative to the size of the market. A standard formula for monopolistic pricing implies that the firm charges the mill price as a constant markup over the marginal cost

$$p^i = \frac{\sigma}{\sigma - 1} w^i a$$

There are variable and fixed costs of delivering products to consumer markets that vary across industries. T_k^{ij} is a melting iceberg transportation cost with $T_k^{ij} > 1, T_k^{ii} = 1$. F_k^{ij} is a fixed cost of exporting that is country-pair and industry specific with $F_k^{ij} > 0, F_k^{ii} = 0$. If the firm chooses to export its product to country j, consumers in country j pay $p_k^{ij} = T_k^{ij} p^i$. It follows that the profit of the firm exporting to country j is

$$\pi_k^{ij}(a) = \frac{\theta_k}{\sigma}\left[\frac{\sigma T_k^{ij} w^i a}{(\sigma-1)P_k^j}\right]^{1-\sigma} Y^j - F_k^{ij}.$$

The firm exports only if it receives positive operating profits, which is more likely if the productivity of the firm $(\frac{1}{a})$ is high, the input price (w^i) is low, and the fixed costs of exporting (F_k^{ij}) are low. The least productive firm that exports to country j has the productivity level $1/a_k^{ij}$ determined as

$$\pi_k^{ij}(a_k^{ij}) = 0 \Leftrightarrow \frac{\theta_k}{\sigma}\left[\frac{\sigma T_k^{ij} w^i a_k^{ij}}{(\sigma-1)P_k^j}\right]^{1-\sigma} Y^j = F_k^{ij}.$$

Parameterization and estimation strategy

[4] We consider a partial equilibrium model with fixed capital during the period being investigated. Labor is the only input that is perfectly mobile across industries but immobile across countries.

Out of N_k^i firms that operate in country *i* in industry *k*, only $N_k^i G_k(a_k^{ij})$ firms export to country *j*. The aggregate export in industry *k* from exporter *i* to country *j* is

$$X_k^{ij} = N_k^i G_k(a_k^{ij}) E\left(p_k^{ij}(a) c_k^{ij}(a) \mid \pi_k^{ij}(a) > 0\right) = N_k^i \theta_k Y^j V_k^{ij} \left(\frac{\sigma T_k^{ij} w^i}{(\sigma - 1) P_k^j} \right)^{1-\sigma}$$

if $a_k^{ij} > a_{\min}$ and $X_k^{ij} = 0$ otherwise, where $V_k^{ij} = \int_{a_{\min}}^{a_k^{ij}} a^{1-\sigma} dG_k(a)$.

The equation can be further simplified by using the equilibrium constraints on the output of sector *k* produced by country *i* that leads to the following export equation

$$X_k^{ij} = s_k^i Y^i Y^j V_k^{ij} \frac{\left(\frac{T_k^{ij}}{P_k^j} \right)^{1-\sigma}}{\sum_{j=1}^{C} \left(\frac{T_k^{ij}}{P_k^j} \right)^{1-\sigma} Y^j V_k^{ij}}, \qquad (1)$$

given the condition

$$\pi_k^{ij}(a_k^{ij}) = 0 \Leftrightarrow \frac{\theta_k}{\sigma} \left[\frac{\sigma T_k^{ij} w^i a_k^{ij}}{(\sigma - 1) P_k^j} \right]^{1-\sigma} Y^j = F_k^{ij}. \qquad (2)$$

Selection of firms

In the following discussion, the industry index *k* is dropped for the reader's convenience. A distribution of productivities or the productivity of the marginal exporter a_t^{ij} is not observable. However, we observe positive and zero trade flows. We define a latent variable Ψ_t^{ij}, the ratio of the variable profits to the fixed cost of for the most productive firm, as

$$\Psi_t^{ij} = \frac{\frac{\theta}{\sigma} \left[\frac{\sigma T^{ij} w_t^i a_{\min}}{(\sigma - 1) P_t^j} \right]^{1-\sigma} Y_t^j}{F_t^{ij}}. \qquad (3)$$

A positive export is observed if $\Psi_t^{ij} \geq 1$.

Trade costs associated with the shipping of a unit of good from country *i* to country *j* are modelled as

$$(T_t^{ij})^{\sigma-1} = (dist^{ij})^{\rho} \exp(R_t^{ij} \gamma - u_t^{ij}),$$

where $dist^{ij}$ is the distance between countries i and j and R is a set of additional variables that determine trade costs. γ is the vector of coefficients associated with R. Finally, u_t^{ij} is an unobservable shock. We further assume that fixed costs are $F_t^{ij} = \exp(\phi^i + \phi^j + \kappa\phi_k^{ij} - \vartheta_t^{ij})$, where ϕ^i represents fixed costs specific to the exporting country, ϕ^j represents fixed costs specific to the importing country, ϕ^{ij} represents country-pair-specific fixed costs, and ϑ_t^{ij} represents country-pair-specific random components.

Taking logs of both sides of equation (3) and substituting expressions for the variable and fixed trade costs yields:

$$\psi_{kt}^{ij} = \zeta_0 + (1-\sigma)\ln w_t^i - \rho \ln dist^{ij} - R_t^{ij}\gamma + d_t^j - \phi^i - \phi^j - \kappa\phi^{ij} + \omega_t^{ij}, \quad (4)$$

where $d_t^j = \ln Y_t^j + \phi^j - (1-\sigma)\ln P_t^j$ is a country j time-specific dummy and $\omega_t^{ij} = u_t^{ij} + \vartheta_t^{ij} \sim N(0, \sigma_u^2 + \sigma_\vartheta^2)$.

We define the probability of positive trade as

$$\rho_t^{ij} = \text{Prob}(X_t^{ij} > 0 \mid \Psi_t^{ij}) = \Phi(\zeta_0 + (1-\sigma)\ln w_t^i - \rho \ln dist^{ij} - R_t^{ij}\gamma + d_t^j - \phi^i - \phi^j - \kappa\phi^{ij}) \quad (5)$$

Equation (5) is a probit model with unobserved non-linear country-pair heterogeneity and potential autocorrelation in the error term. Since we use panel data, the model have additional complications. First, there is high level of persistence in trade between country pairs. In addition, an error term may contain an autocorrelation due to macroeconomic and other unobservable shocks. To account for the panel dimension of the data in the probit specification, we employ the methodology outlined in Wooldridge (2005), which deals with both dynamic aspect of trade and with autocorrelation in the error term. The identifying assumption here is that the unobserved heterogeneity is random, potentially depends on initial trade status, observable trade costs and other observable characteristics of countries i and j, and has a normal conditional density function. In practical terms, we estimate (5) adding initial state of countries trade, $\text{Trade}_{ij,t0}$ and period average values for all time varying dependent variables.

For better identification, several variables that affect fixed costs but that have no effect on the volume of trade (and thus are included in the selection equation but not the gravity equation) are needed. Based on the results from Helpman, Melitz, and Rubinstein (2008), we control for pair-specific fixed costs by including a common religion dummy as one of the variables that affects the decision of a firm to trade but has no significant impact on the volume of trade. To control for the exporter country-specific fixed costs, we include number of documents required to export from country i and number of documents required to import to country j.

These two variables do not vary with volume of exports per transaction and, almost by definition, are counted as the transaction fixed costs.

Gravity equation

Taking the logs of both sides of equation (1) and substituting for T_t^{ij} yields

$$\ln X_t^{ij} = \ln s_t^i + \ln Y_t^i + \ln Y_t^j - \rho \ln dist^{ij} - R_t^{ij}\gamma + \ln V_t^{ij} -$$

$$(1-\sigma)\ln P_t^j - \ln MRT_t^j + u_t^{ij} = Z_t^{ij}\pi + u_t^{ij} \qquad (6)$$

where $\ln MRT_t^{\ j} = \ln\left(\sum_{j=1}^{C}\left(\frac{T_t^{ij}}{P_t^j}\right)^{1-\sigma} Y^j V_t^{ij}\right)$

is the multilateral resistance term, an integral measure of trade barriers of a country vis-à-vis all its trading partners (Anderson and van Wincoop, 2003), which accounts for the endogenous and simultaneous determination of trade flows across all countries. The multilateral resistance term is not observable and according to theory is simultaneously determined for all countries. We control for the MRT following the Baier and Bergstrand (2009) procedure.

We treat the unobserved heterogeneity semi-parametrically and use the information acquired at the first stage of the estimation by identifying $E(\ln V_t^{ij} + u_t^{ij} \mid X_t^{ij} > 0) = b_0\hat{\eta}_t^{ij} + \sum_{m=1}^{3} b_m(\hat{\psi}_t^{ij})^m$, where $\hat{\eta}_t^{ij}$ is the inverse Mills ratio that accounts for the sample selection bias and the polynomial of degree three in $\hat{\psi}_t^{ij} = \hat{\eta}_t^{ij} + \Phi^{-1}(\hat{\rho}_t^{ij})$ corrects for the firm-level heterogeneity. As shown by Helpman et al. (2008), the polynomial of degree 3 is a sufficiently flexible and accurate approximation of the underlying unknown function of the distribution of productivity $G(a)$. We estimate (6) by the Hausman-Taylor method (Hausman and Taylor, 1981) that uses time-varying variables that are not correlated with u_t^{ij} as instruments for endogenous components of Z. As a robustness check, we also present the results with the country-pair fixed effects included into the estimation equation.

Table 2 Gravity model variables: definitions and data sources

Variables	Description	Sources
Dependent variables		
$Trade_{ijk,t}$	Binary variable equal to 1 if exports of product k from i to j at time t are positive and zero otherwise	Author's calculations
$Export_{ijk,t}$	Export from i to j of product k at time t, in thousands of current $US. COMTRADE exports data of HS six and four -digit product categories in 1996-2010	United Nations Commodity Trade Statistics Database
Endogenous variables		
$SPS_{jk,t}$	Binary variable equal to 1 if country j reported a SPS measure on product k at time t	WTO I-TIP database
$TBT_{jk,t}$	Binary variable equal to 1 if country j reported a TBT measure on product k at time t	WTO I-TIP database
$STC_{ijk,t}$	Binary variable equal to 1 if country i has complained against country j about SPS or TBT measure imposed on product k at time t	WTO I-TIP database
Independent variables		
$\ln(share\ export_{ki,t})$	Ln export share of product k in total export of country i at time t.	Author's calculations
$\ln(GDP_{i,t})$	Ln gross domestic product of country i at time t, in current million $US	WDI (2012)
$\ln(GDP_{j,t})$	Ln gross domestic product of country j at time t, in current million $US	WDI (2012)
$\ln(distance_{ij})$	$d_{ij} = \sum_{k \in i}(pop_k / pop_i) \sum_{l \in j}(pop_l / pop_j) d_{kl}$ Ln distance between the biggest cities of countries i and j. d_{kl} is the distance between cities k and l.	CEPII
$Common\ border_{ij}$	Binary variable indicating whether the two countries are contiguous, 1 or not	CEPII
$Colony_{ij}$	Binary variable set equal to 1 if countries i and j have had colonial ties	CEPII
$Common\ language_{ij}$	Binary variable indicating whether countries i and j share a common language (a language is spoken by at least 9% of the population in both countries)	CEPII
$Common\ legal\ origin_{ij}$	Binary variable set equal to 1 if countries i and j share a common origin of the legal system. The origins are British, French, German, Soviet	CEPII
$\ln(shipping\ cost_i)$	Ln cost of shipping a container from country i, period average	Doing Business (2012)
$\ln(shipping\ cost_j)$	Ln cost of shipping a container to country j, period average	Doing Business (2012)
$WTO_{i,t}$	Binary variable indicating whether country i is a WTO member on or before date t	WTO website

Variables	Description	Sources
$WTO_{j,t}$	Binary variable indicating whether country j is a WTO member on or before date t	WTO website
$RTA_{ij,t}$	Binary variable indicating whether countries i and j signed a regional trade agreement on or before date t	WTO website
Selection variables		
ln(GDP per capita$_{i,t}$)	log GDP per capita of country i , in current thousand $US	WDI (2012)
Common religion$_{ij}$	Binary variable set equal to 1 if countries i and j share the same religion.	CEPII
ln(doc$_i$)	log Number of documents to export from country i, period average	Doing Business (2012)
ln(doc$_j$)	log Number of documents to import to country j, period average	Doing Business (2012)

Results

Aggregate results

Table 3 reports the results of the first (probit) and second (HT and FE) stages of estimating the effect of STB/TBT on exports for the samples of aggregate seafood trade (all product categories), raw and semi-processed seafood (HS two-digit code 03), and processed seafood (HS four-digit codes 1603, 1604, and 1605). The dependent variable in the probit model is the probability of positive export from country i to country j at time t. The dependent variable in HT and FE models is the natural logarithm of exports from country i to country j at time t.

For the probability of trade, where the marginal effects are reported in the first column of Table 3, SPS measures and STCs enter the equation with mostly positive and significant coefficients, while TBT measures are significantly negative for the processed seafood sample only. The positive effect of SPS measures and STCs points to the endogeneity problem. SPS are more likely to be imposed by countries that import seafood products from more countries. STCs are more likely to be raised if the NTBs affect existing export flows. The positive news is that those measures do not create a prohibitive trade barriers on the extensive margins of seafood trade. Perhaps it indicates that the SPS and STC have small impact on fixed costs of exporting and fixed cost of compliance are small. TBT measures have influence seafood exports on the extensive margins negatively, but not significantly in two out of three samples. However, coefficients on TBT is negative and statistically significant for the processed seafood, meaning that TBT measures reduce exports on the extensive margins, perhaps by having a higher fixed costs of compliance.

Other variables have expected signs. Countries with larger market size are more likely to attract positive trade flows as indicated by the positive coefficient of $\ln(GDP_{j,t})$. Distance reduces the likelihood of positive exports. Positive exports show strong persistence and strongly depend on the initial conditions as indicated by large and significant coefficients of $Trade_{ijh,t-1}$ and $Trade_{ijh,1996}$. Trade facilitation measures of the exporting country measured by cost of shipping a container and number of documents required to export have a strong negative effect on the likelihood of exports, while trade facilitation measures of the importing country enter both positively (number of documents required to import) and negatively (cost of shipping a container to country j). Countries that share a common language, have common border, colonial ties, and common legal origin are more likely to trade seafood products. Multilateral and bilateral trade agreements promote seafood trade on the extensive margins.

Table 3 Aggregate seafood trade: effect of NTBs on extensive and intensive margins

	All Seafood			Raw and semi-processed seafood (HS 03)			Processed seafood (HS 1603, 1604, 1605)		
	Probit	HT	FE	Probit	HT	FE	Probit	HT	FE
SPS	0.0057***	-0.052	-0.025	0.0028*	0.0016	0.030	0.0093***	-0.038	-0.022
	(0.001)	(0.037)	(0.026)	(0.001)	(0.040)	(0.027)	(0.001)	(0.040)	(0.032)
TBT	-0.0027	0.053	0.10*	-0.0035	0.017	0.031	-0.0040**	0.082	0.11***
	(0.003)	(0.076)	(0.052)	(0.002)	(0.072)	(0.057)	(0.001)	(0.051)	(0.030)
STC	0.10***	-0.27*	-0.12	0.080***	-0.12	0.0053	0.080***	-0.82*	-0.77***
	(0.008)	(0.133)	(0.100)	(0.006)	(0.130)	(0.087)	(0.008)	(0.379)	(0.230)
ln(GDP per capita$_{i,t}$)	-0.0071***			-0.0046**			-0.0029*		
	(0.002)			(0.002)			(0.001)		
Mean ln(GDP per capita$_i$)	0.015***			0.012***			0.011***		
	(0.002)			(0.002)			(0.002)		
ln(share export$_{i_k,t}$)		0.42***	0.32***		0.40***	0.32***		0.36***	0.29***
		(0.030)	(0.013)		(0.031)	(0.013)		(0.029)	(0.012)
ln(GDP$_{i,t}$)		0.38***	0.37***		0.35***	0.27***		0.29***	0.63***
		(0.023)	(0.034)		(0.019)	(0.038)		(0.029)	(0.045)
ln(GDP$_{j,t}$)	0.015***	0.58***	0.87***	0.014***	0.57***	0.88***	0.0095***	0.44***	0.66***
	(0.001)	(0.019)	(0.031)	(0.001)	(0.019)	(0.035)	(0.001)	(0.023)	(0.040)
Mean ln(GDP$_j$)	-0.0026			-0.0016			-0.0023		
	(0.001)			(0.001)			(0.001)		
ln(distance$_{ij}$)	-0.015***	-0.61***		-0.013***	-0.59***		-0.011***	-0.40***	
	(0.001)	(0.048)		(0.001)	(0.056)		(0.000)	(0.062)	
Trade$_{ij,t-1}$	0.23***			0.21***			0.17***		
	(0.001)			(0.001)			(0.001)		
Trade$_{ij,1996}$	0.074***			0.073***			0.051***		
	(0.001)			(0.001)			(0.001)		
ln(shipping cost$_i$)	-0.039***	-1.15***		-0.029***	-0.67***		-0.036***	-2.09***	
	(0.003)	(0.191)		(0.003)	(0.188)		(0.002)	(0.254)	
ln(shipping cost$_j$)	-0.0051*	0.38*		-0.0083***	0.097		-0.0028	1.08***	
	(0.002)	(0.163)		(0.002)	(0.152)		(0.002)	(0.197)	
ln(docs$_i$)	-0.0048*			0.0040			-0.015***		
	(0.002)			(0.002)			(0.002)		
ln(docs$_j$)	0.016***			0.0055*			0.020***		
	(0.002)			(0.002)			(0.002)		
Common language$_{ij}$	0.012***	0.18*		0.012***	0.16*		0.0083***	0.22*	
	(0.001)	(0.073)		(0.001)	(0.077)		(0.001)	(0.095)	
Common border$_{ij}$	0.046***	1.11***		0.047***	0.96***		0.023***	1.09***	
	(0.003)	(0.144)		(0.002)	(0.151)		(0.002)	(0.144)	
Colonial ties$_{ij}$	0.042***	0.37		0.039***	0.24		0.035***	0.34	
	(0.004)	(0.191)		(0.003)	(0.172)		(0.003)	(0.177)	

Common legal origin$_{ij}$	0.011***	0.36***		0.0094***	0.27***		0.011***	0.53***	
	(0.001)	(0.060)		(0.001)	(0.055)		(0.001)	(0.073)	
Common religion$_{ij}$	-0.0032*			-0.0062***			0.0015		
	(0.002)			(0.002)			(0.001)		
WTO$_{i,t}$	0.011***	0.30***		0.023***	0.24*		0.0028**	0.49***	
	(0.001)	(0.082)		(0.001)	(0.095)		(0.001)	(0.111)	
WTO$_{j,t}$	0.019***	-0.017		0.0081***	-0.038		0.0049***	-0.021	
	(0.001)	(0.067)		(0.001)	(0.069)		(0.001)	(0.080)	
RTA$_{ij,t}$	0.023***	-0.16**	-0.046	0.019***	-0.11	0.023	0.017***	-0.099	
	(0.001)	(0.058)	(0.038)	(0.001)	(0.056)	(0.042)	(0.001)	(0.084)	
Remoteness distance		-0.050			0.18			0.45	
		(0.833)			(0.795)			(0.863)	
Remoteness border		9.99*			11.7**			24.0***	
		(4.081)			(4.531)			(5.099)	
Remoteness RTA		1.47*			2.06*			-0.77	
		(0.643)			(0.851)			(0.810)	
Remoteness colony		-5.19			-2.76			3.24	
		(4.007)			(4.763)			(5.667)	
Remoteness legal		10.1***			9.12***			5.01***	
		(1.147)			(1.283)			(1.509)	
Nu		-0.48**	-0.20		-0.48*	-0.20		-0.15	0.080
		(0.175)	(0.147)		(0.188)	(0.154)		(0.213)	(0.182)
Z		-2.69*	-0.66		-2.49	-0.32		0.34	1.90
		(1.274)	(1.084)		(1.438)	(1.166)		(1.663)	(1.469)
z2		1.89*	0.70		1.77*	0.46		0.039	-0.86
		(0.739)	(0.632)		(0.849)	(0.689)		(1.014)	(0.892)
z3		-0.34*	-0.14		-0.34*	-0.10		0.036	0.19
		(0.140)	(0.121)		(0.163)	(0.134)		(0.208)	(0.178)
Chi-squared	203148.8	71086.7		185543.4	21658.5		146682.0	18324.1	
Pseudo R2	0.57		0.29	0.56		0.28	0.59		0.24
Observations	378954	66918	66918	376677	58170	58170	348342	39402	39402

For probit model marginal effects are reported. Standard errors in parentheses

* p<0.05, ** p<0.01, *** p<0.001

Table 3 also reports the estimates of the effect of NTBs on seafood exports at the intensive margins of trade, using the Hausman-Taylor specification (HT) and country-pair fixed effects (FE). The HT method is more efficient but can produce biased estimates if the endogenous variables are not properly instrumented. Both methods produce results that indicate that SPS measures and STCs have a negative effect on the value of trade, while TBTs have positive effect on the value of trade. This is consistent with the story that SPS measures influence variable trade costs, while TBT

measures have larger effect on fixed exporting costs that cut off the least efficient counties from exporting and, hence, increase the export of the most efficient producers. As a result, imposing a TBT sets prohibitive barriers to trade for all firms in some countries and narrows the set of exporters from other countries – only the most productive firms are able to export with non-negative profits but at larger quantities. It also may indicate that TBT are more frequently applied against countries that import seafood more intensively.

WTO members export more seafood. WTO members also import more, but it is mostly due to wider variety of imports from different countries, not due to larger value of import per exporter. RTAs do not robustly promote exports at the intensive margins of trade. To the contrary, value of trade is lower if countries have a bilateral trade agreement. However, this result cannot be interpreted separately from the fact that the bilateral trade agreement has a strong positive effect on the probability of trade. RTAs reduce fixed costs of trade leading to larger variety of goods exported to more countries but in smaller volume. Other variables have expected signs and work similarly as for extensive margins of trade. Countries that share a common language, have common border, colonial ties, and common legal origin are more likely to trade seafood products. Variables that control for selection and firm heterogeneity are jointly significant, indicating presence of both sources of bias and warranting for their correction.

Results at 4 digit level

We also analyze the effect of NTBs on export of seafood at more disaggregated level, because of high potential heterogeneity of the impact of NTBs on different types of products (i.e. SPS applied to fresh fish vs SPS applied to frozen fish may differ in terms and cost of compliance). Also, there is a large variability in the scope and intensity of NTBs across product lines. For instance export of shrimps, which is the largest item of global seafood trade in terms of value, has been heavily targeted by SPS measure both in EU and US. In this section we report the results of the analysis at HS four-digit level of aggregation. The results are broadly *i* agreement with the results for the more aggregated data, however the results differ across product lines quite substantially.

Extensive margins of trade

Table 4 reports the results of the first stage estimation of the probability of positive export for the HS four-digit product categories. SPS measures and STCs enter the equation with mostly positive and significant coefficients, while TBT measures are mostly insignificant. Similarly to the aggregate results, the positive effect of SPS measures and STCs points to the endogeneity problem. SPS are more likely to be imposed by countries that import seafood products from more countries. STCs are more likely to be raised if the NTBs affect existing export flows. TBT measures have influence seafood exports on the extensive margins on a smaller scale, both in terms of statistical significance (only three product categories out of ten) and in terms of economic magnitude. However, coefficients on TBT are mostly negative and in two cases (0305 Fish, dried, salted or in brine; smoked fish and 0306 Crustaceans) are statistically significant. It can be concluded that TBT measures reduce exports on the extensive margins, perhaps by having a higher fixed costs of compliance.

Other variables have expected signs. Countries with larger market size are more likely to attract positive trade flows as indicated by the positive coefficient of $\ln(GDP_{j,t})$. Distance reduces the likelihood of positive exports. Positive exports show strong persistence and strongly depend on the initial conditions as indicated by large and significant coefficients of $Trade_{ijh,t-1}$ and $Trade_{ijh,1996}$. Trade facilitation measures of the exporting country measured by cost of shipping a container and number of documents required to export have a strong negative effect on the likelihood of exports for most product categories, while trade facilitation measures of the importing country are less robust to predict probability of export. Countries that share a common language, have common border, colonial ties, and common legal origin are more likely to trade seafood products. Multilateral and bilateral trade agreements promote seafood trade on the extensive margins.

Table 4 First stage results at HS four-digit level: Probit model

HS 4-digit	0301	0302	0303	0304	0305	0306	0307	1603	1604	1605
SPS	0.040**	0.066***	-0.020	0.054***	-0.018	0.043***	0.040**	0.11***	0.10***	0.090***
	(0.015)	(0.013)	(0.012)	(0.013)	(0.014)	(0.013)	(0.013)	(0.025)	(0.015)	(0.020)
TBT	0.012	-0.045	-0.037	-0.058	0.084**	-0.11***	-0.065*	-0.028	-0.027	-0.029
	(0.031)	(0.030)	(0.022)	(0.031)	(0.026)	(0.025)	(0.028)	(0.028)	(0.016)	(0.021)
STC	0.59***	0.60***	0.55***	0.72***	0.44***	0.65***	0.60***	-0.30	0.88***	0.78***
	(0.052)	(0.048)	(0.052)	(0.051)	(0.052)	(0.059)	(0.055)	(0.231)	(0.085)	(0.099)
ln(GDP per capitai,t)	-0.17***	-0.073**	-0.050**	-0.031	-0.052*	-.073***	-0.059**	0.026	-0.042*	-0.0031
	(0.026)	(0.023)	(0.019)	(0.021)	(0.023)	(0.022)	(0.022)	(0.041)	(0.020)	(0.026)
Mean ln(GDP per capitai)	0.15***	0.15***	0.17***	0.081***	0.11***	0.100***	0.13***	0.16***	0.16***	0.10***
	(0.027)	(0.024)	(0.019)	(0.021)	(0.023)	(0.022)	(0.023)	(0.042)	(0.020)	(0.027)
ln(GDPj,t)	0.18***	0.17***	0.17***	0.13***	0.15***	0.13***	0.19***	0.11**	0.12***	0.18***
	(0.023)	(0.019)	(0.016)	(0.018)	(0.019)	(0.018)	(0.019)	(0.033)	(0.016)	(0.021)
Mean ln(GDPj)	-0.019	-0.026	-0.053***	-0.0057	-0.020	0.011	-0.063***	0.042	-0.036*	-0.056**
	(0.022)	(0.019)	(0.016)	(0.018)	(0.019)	(0.018)	(0.019)	(0.033)	(0.016)	(0.021)
ln(distanceij)	-0.14***	-0.23***	-0.11***	-0.14***	-0.19***	-0.15***	-0.12***	-0.17***	-0.15***	-0.14***
	(0.008)	(0.007)	(0.006)	(0.007)	(0.007)	(0.007)	(0.007)	(0.012)	(0.006)	(0.008)
Tradeijh,t-1	2.40***	2.04***	2.18***	2.27***	2.12***	2.17***	2.22***	2.22***	2.27***	2.30***
	(0.014)	(0.013)	(0.010)	(0.012)	(0.012)	(0.012)	(0.012)	(0.022)	(0.010)	(0.014)
Tradeijh,1996	0.65***	0.76***	0.77***	0.74***	0.78***	0.76***	0.80***	0.73***	0.64***	0.77***
	(0.022)	(0.019)	(0.016)	(0.017)	(0.017)	(0.018)	(0.018)	(0.031)	(0.015)	(0.020)
ln(shipping costi)	-0.022	-0.46***	-0.51***	-0.22***	-0.23***	-0.35***	-0.54***	-0.52***	-0.59***	-0.31***
	(0.047)	(0.034)	(0.030)	(0.035)	(0.036)	(0.035)	(0.036)	(0.069)	(0.031)	(0.045)
ln(shipping costj)	-0.47***	0.10***	0.13***	-0.038	-0.057	-0.012	0.18***	0.38***	0.050	-0.19***
	(0.043)	(0.031)	(0.028)	(0.033)	(0.034)	(0.032)	(0.033)	(0.065)	(0.030)	(0.042)
ln(docsi)	-0.12***	0.045	0.18***	-0.00010	-0.16***	-0.23***	-0.0031	0.15**	-0.22***	-0.13***

HS 4-digit	0301	0302	0303	0304	0305	0306	0307	1603	1604	1605
	(0.035)	(0.030)	(0.025)	(0.028)	(0.030)	(0.028)	(0.029)	(0.052)	(0.026)	(0.034)
ln(docsj)	-0.0052	0.0000074	0.12***	-0.054	-0.022	0.081**	0.082**	0.015	0.28***	0.12***
	(0.035)	(0.030)	(0.025)	(0.028)	(0.029)	(0.028)	(0.029)	(0.049)	(0.026)	(0.034)
Common languageij	0.13***	0.15***	0.12***	0.100***	0.16***	0.16***	0.14***	0.22***	0.11***	0.13***
	(0.016)	(0.014)	(0.012)	(0.014)	(0.014)	(0.013)	(0.014)	(0.023)	(0.013)	(0.016)
Common borderij	0.36***	0.32***	0.42***	0.30***	0.39***	0.29***	0.34***	0.27***	0.28***	0.29***
	(0.030)	(0.025)	(0.025)	(0.027)	(0.026)	(0.026)	(0.028)	(0.040)	(0.026)	(0.031)
Colonial tiesij	0.29***	0.41***	0.32***	0.34***	0.45***	0.35***	0.32***	0.26***	0.49***	0.42***
	(0.041)	(0.034)	(0.034)	(0.035)	(0.034)	(0.035)	(0.036)	(0.052)	(0.036)	(0.037)
Common legal originij	0.092***	0.11***	0.12***	0.085***	0.094***	0.10***	0.11***	0.11***	0.15***	0.11***
	(0.013)	(0.011)	(0.010)	(0.011)	(0.011)	(0.011)	(0.011)	(0.020)	(0.010)	(0.013)
Common religionij	-0.060*	-0.030	-.083***	-0.046*	-0.12***	0.012	-.097***	-0.050	0.022	-.090***
	(0.023)	(0.020)	(0.018)	(0.019)	(0.021)	(0.019)	(0.020)	(0.034)	(0.018)	(0.024)
WTOi,t	0.38***	0.23***	0.19***	0.21***	0.19***	0.22***	0.18***	0.26***	-0.030*	0.12***
	(0.021)	(0.016)	(0.014)	(0.015)	(0.016)	(0.015)	(0.016)	(0.041)	(0.014)	(0.019)
WTOj,t	0.10***	0.084***	0.054***	0.051***	0.13***	0.077***	0.065***	0.18***	0.067***	0.018
	(0.018)	(0.015)	(0.012)	(0.013)	(0.015)	(0.014)	(0.014)	(0.029)	(0.012)	(0.016)
RTAij,t	0.076***	0.18***	0.17***	0.20***	0.24***	0.17***	0.20***	0.12***	0.23***	0.24***
	(0.020)	(0.016)	(0.015)	(0.016)	(0.016)	(0.016)	(0.017)	(0.026)	(0.015)	(0.018)
Chi-squared	85103.9	91188.4	125871.7	112191.8	100354.8	102793.9	100488.1	35851.6	135389.2	88946.0
Pseudo R^2	0.61	0.56	0.56	0.58	0.58	0.56	0.58	0.59	0.58	0.61
Observations	334464	364852	357531	343633	352902	343398	331140	213118	343478	305694

Dependent variable is an indicator whether export from country i to country j in product h at time t is positive or not. The model is estimated by probit,
taking into account the panel component as suggested by Wooldridge (2005) Standard errors in parentheses. Time fixed effects are included but not reported.
* p<0.05, ** p<0.01, *** p<0.001

Intensive margins of trade: Hausman-Taylor results

Table 5 presents the results of estimation of the gravity equation using the Hausman-Taylor method. The effect of the NTBs at the intensive margins is not as strong as at the extensive margins. SPS measures are negative and significant in two out of ten cases, while positive and significant for fish fillet and other fish meat (HS 0304). There is a view that introduction of SPS measures may serve as a catalyst of trade if consumers are concerned about food quality and safety. In this case introducing an SPS measure that improves quality and safety would stimulate demand leading to positive association between an NTB and export. TBT measures have mostly positive effect on export value, indicating their relatively larger influence on fixed rather than variable trade costs. However, the coefficient on TBT is statistically significant only for Crustaceans (HS 0306). STCs effect on export volume is al-

ways negative and significant for six out of ten product lines. Unlike SPS and TBT measures that do not vary across exporters, STC is defined at bilateral level. It is natural to expect that the concern is raised by exporting country that is hurt by the SPS measure the most. Therefore, we take it is the evidence of negative association between STCs and volume of trade, rather than as causal effect of NTBs on export.

Table 5 Effect of NTBs on intensive margins of export for HS 4-digit products: Hausman-Taylor estimation

HS 4 digit code	0301	0302	0303	0304	0305	0306	0307	1603	1604	1605
SPS	-0.048	0.0028	-0.073*	0.092**	-0.0027	-0.20***	-0.013	0.019	-0.026	0.059
	(0.035)	(0.048)	(0.030)	(0.033)	(0.036)	(0.039)	(0.039)	(0.074)	(0.031)	(0.047)
TBT	-0.046	0.055	0.11	0.0097	0.034	0.19*	-0.078	0.071	0.035	0.037
	(0.070)	(0.103)	(0.069)	(0.079)	(0.079)	(0.088)	(0.077)	(0.069)	(0.030)	(0.042)
STC	-0.24**	-0.59***	-0.16	-0.35***	-0.17	-0.41***	-0.30**	-0.16	-0.60**	-0.73
	(0.088)	(0.109)	(0.092)	(0.100)	(0.123)	(0.105)	(0.096)	(0.508)	(0.191)	(0.393)
ln(share exportik,t)	0.24***	0.26***	0.27***	0.36***	0.24***	0.34***	0.20***	0.29***	0.32***	0.33***
	(0.030)	(0.029)	(0.028)	(0.022)	(0.027)	(0.029)	(0.029)	(0.029)	(0.029)	(0.033)
ln(GDPi,t)	0.29***	0.26***	0.26***	0.23***	0.23***	0.23***	0.29***	0.38***	0.20***	0.33***
	(0.032)	(0.036)	(0.025)	(0.027)	(0.032)	(0.034)	(0.026)	(0.051)	(0.027)	(0.038)
ln(GDPj,t)	0.50***	0.43***	0.37***	0.49***	0.31***	0.53***	0.48***	0.36***	0.37***	0.53***
	(0.034)	(0.028)	(0.023)	(0.024)	(0.027)	(0.029)	(0.027)	(0.049)	(0.022)	(0.027)
ln(distanceij)	-0.53***	-0.52***	-0.20***	-0.35***	-0.31***	-0.45***	-0.35***	-0.19*	-0.34***	-0.49***
	(0.067)	(0.081)	(0.055)	(0.059)	(0.077)	(0.074)	(0.080)	(0.083)	(0.059)	(0.063)
ln(shipping costi)	-0.69	-0.66*	-0.50*	-1.02***	0.29	-0.35	-1.40***	-0.027	-2.09***	-1.50***
	(0.413)	(0.275)	(0.239)	(0.277)	(0.297)	(0.356)	(0.341)	(0.413)	(0.269)	(0.415)
ln(shipping costj)	-0.067	0.20	0.23	0.58*	-0.63*	-0.16	0.92**	-0.23	1.05***	0.39
	(0.350)	(0.240)	(0.190)	(0.270)	(0.256)	(0.324)	(0.315)	(0.357)	(0.255)	(0.419)
Common languageij	0.27*	0.13	-0.065	-0.0039	0.063	0.0061	-0.18	0.19	0.065	0.40**
	(0.121)	(0.113)	(0.077)	(0.115)	(0.120)	(0.112)	(0.125)	(0.152)	(0.124)	(0.122)
Common borderij	0.53*	0.77***	0.60***	0.54***	0.65***	0.17	0.58***	0.26	1.24***	0.40*
	(0.213)	(0.170)	(0.147)	(0.140)	(0.145)	(0.159)	(0.158)	(0.294)	(0.141)	(0.173)
Colonial tiesij	-0.045	-0.30	-0.0045	-0.17	0.36	-0.11	-0.36	0.35	0.36	0.13
	(0.253)	(0.208)	(0.258)	(0.168)	(0.229)	(0.241)	(0.213)	(0.277)	(0.225)	(0.217)
Common legal originij	0.27**	0.28**	0.14*	0.022	0.091	0.38***	0.25**	0.18	0.58***	0.24**
	(0.084)	(0.093)	(0.066)	(0.082)	(0.072)	(0.108)	(0.095)	(0.157)	(0.071)	(0.087)
WTOi,t	-0.25*	-0.61***	0.16	0.18	0.22	-0.11	0.18	-0.11	0.51***	0.39*
	(0.110)	(0.116)	(0.114)	(0.095)	(0.163)	(0.130)	(0.106)	(0.379)	(0.119)	(0.168)
WTOj,t	0.0055	0.31*	0.067	0.15	-0.20	-0.20	-0.023	-0.32	-0.020	0.11
	(0.125)	(0.140)	(0.084)	(0.085)	(0.116)	(0.120)	(0.101)	(0.292)	(0.088)	(0.098)
RTAij,t	-0.21	-0.043	-0.22*	-0.013	0.15	-0.080	-0.22*	0.33	-0.11	0.057
	(0.110)	(0.127)	(0.091)	(0.089)	(0.116)	(0.119)	(0.112)	(0.227)	(0.084)	(0.106)

HS 4 digit code	0301	0302	0303	0304	0305	0306	0307	1603	1604	1605
Remoteness distance	-3.46***	-1.51	1.31	-0.12	1.39	1.55	4.03***	1.61	-0.060	1.08
	(0.998)	(1.513)	(0.798)	(0.969)	(1.106)	(1.127)	(0.916)	(1.822)	(1.050)	(1.171)
Remoteness border	-14.3*	-6.14	6.60	25.1***	11.7*	19.7**	12.6*	1.08	22.4***	30.7***
	(7.196)	(5.088)	(4.262)	(4.475)	(5.779)	(6.929)	(6.257)	(7.319)	(4.843)	(5.649)
Remoteness RTA	3.42**	-2.16	0.93	-0.69	-2.53*	0.75	0.46	-7.53**	0.069	-3.36**
	(1.176)	(1.380)	(1.141)	(1.293)	(1.216)	(1.592)	(1.379)	(2.801)	(0.993)	(1.224)
Remoteness colony	1.11	8.61	1.24	8.17	-2.46	-0.026	14.7*	4.05	6.20	-0.30
	(6.001)	(7.905)	(6.335)	(8.343)	(5.730)	(7.925)	(6.797)	(12.311)	(7.405)	(6.612)
Remoteness legal	0.45	6.19**	3.96*	4.80*	3.59	9.08***	4.26*	0.33	7.14***	1.67
	(2.283)	(2.174)	(1.547)	(2.096)	(1.942)	(2.019)	(1.954)	(3.615)	(1.830)	(2.749)
n	0.25	-0.83**	-0.35	-0.24	-0.42	-0.097	-0.58	0.62	0.11	-0.027
	(0.253)	(0.289)	(0.251)	(0.252)	(0.323)	(0.286)	(0.304)	(0.554)	(0.278)	(0.274)
z	3.13	-6.69**	-2.19	-0.59	-0.83	0.52	-5.06	7.25	2.54	0.30
	(2.348)	(2.574)	(2.144)	(2.244)	(3.048)	(2.635)	(2.942)	(5.752)	(2.312)	(2.419)
z^2	-1.67	4.85**	2.06	0.75	0.24	-0.013	3.86*	-4.28	-1.33	0.42
	(1.525)	(1.660)	(1.360)	(1.403)	(2.010)	(1.733)	(1.963)	(3.953)	(1.416)	(1.533)
z^3	0.37	-0.94**	-0.47	-0.12	0.13	0.069	-0.81	0.91	0.31	-0.10
	(0.325)	(0.353)	(0.286)	(0.287)	(0.440)	(0.378)	(0.432)	(0.900)	(0.284)	(0.319)
Chi-squared	5899.0	3783.7	9442.2	13234.6	4306.2	8739.5	5695.8	2371.6	28263.0	10593.8
Observations	17637	21266	33678	27372	23206	25246	23820	6813	35713	19213

Dependent variable is export from country i to country j of product k at time t. The model is estimated by Hausman-Taylor method, treating SPS, TPT, and STC measures as endogenous. Time fixed effects are included but not reported. Bootstrap standard errors in parentheses

* p<0.05, ** p<0.01, *** p<0.001

Intensive margins of trade: Fixed effect results

Table 6 presents the results of estimation of the gravity equation using the country-pair fixed effects. This estimation is robust to correlation of our explanatory variables with unobserved time-invariant country-pair specific characteristics that are not captured by other time-invariant country-pair variables such as distance, pair-specific trade costs, etc. For instance, it takes into account political tension between countries, which are likely to be positively correlated with NTBs. The results are broadly in agreement with the results estimated by the Hausman-Taylor method.

Table 6 Effect of NTBs on intensive margins of export for HS 4-digit products: fixed effect estimation

HS 4 digit code	0301	0302	0303	0304	0305	0306	0307	1603	1604	1605
SPS	-0.029	0.095	-0.049	0.10**	0.036	-0.14***	-0.049	0.063	0.0049	0.050
	(0.036)	(0.049)	(0.031)	(0.035)	(0.038)	(0.040)	(0.041)	(0.076)	(0.033)	(0.049)
TBT	-0.040	0.038	0.16*	0.028	-0.0020	0.19*	-0.069	0.10	0.075*	0.070
	(0.073)	(0.111)	(0.073)	(0.084)	(0.084)	(0.094)	(0.082)	(0.074)	(0.032)	(0.044)
STC	-0.15	-0.48***	-0.064	-0.23*	-0.095	-0.33**	-0.15	-0.29	-0.58**	-0.57
	(0.093)	(0.119)	(0.098)	(0.108)	(0.132)	(0.114)	(0.103)	(0.545)	(0.206)	(0.427)
ln(share exportik,t)	0.23***	0.23***	0.22***	0.31***	0.19***	0.29***	0.14***	0.28***	0.24***	0.31***
	(0.015)	(0.014)	(0.013)	(0.015)	(0.015)	(0.016)	(0.014)	(0.024)	(0.013)	(0.015)
ln(GDPi,t)	0.36***	0.18*	0.14**	0.43***	0.34***	0.13	0.19**	0.64***	0.50***	0.55***
	(0.067)	(0.083)	(0.051)	(0.057)	(0.070)	(0.071)	(0.060)	(0.125)	(0.050)	(0.072)
ln(GDPj,t)	0.82***	1.07***	0.71***	0.91***	0.45***	0.84***	0.65***	0.18	0.64***	0.75***
	(0.062)	(0.071)	(0.047)	(0.055)	(0.056)	(0.062)	(0.059)	(0.123)	(0.042)	(0.065)
Regional trade agreementij,t	-0.068	-0.11	-0.13*	0.00041	0.057	-0.014	-0.15*	0.020	-0.052	-0.054
	(0.069)	(0.072)	(0.055)	(0.059)	(0.066)	(0.073)	(0.064)	(0.130)	(0.048)	(0.070)
n	0.54*	-0.51*	0.11	-0.067	-0.0035	0.15	-0.31	0.87*	0.47*	0.037
	(0.236)	(0.237)	(0.229)	(0.220)	(0.235)	(0.247)	(0.228)	(0.359)	(0.201)	(0.232)
z	5.61**	-3.75	1.62	0.74	2.47	2.67	-2.95	9.41**	5.23**	0.62
	(2.120)	(2.175)	(2.013)	(1.918)	(2.128)	(2.201)	(2.023)	(3.472)	(1.675)	(2.010)
z^2	-3.21*	2.86*	-0.32	-0.063	-1.83	-1.47	2.53	-5.67*	-2.91**	0.23
	(1.357)	(1.437)	(1.296)	(1.213)	(1.388)	(1.422)	(1.299)	(2.316)	(1.035)	(1.262)
z^3	0.65*	-0.56	-0.012	0.0085	0.54	0.36	-0.57*	1.17*	0.60**	-0.088
	(0.288)	(0.317)	(0.278)	(0.254)	(0.303)	(0.305)	(0.277)	(0.510)	(0.212)	(0.262)
R^2	0.23	0.25	0.21	0.33	0.22	0.28	0.28	0.22	0.19	0.34
Observations	17637	21266	33678	27372	23206	25246	23820	6813	35713	19213

Dependent variable is export from country i to country j of product k at time t. Country-pair and time fixed effects are included, but not reported. Standard errors in parentheses.

* p<0.05, ** p<0.01, *** p<0.001

Conclusions

We analyze the effect of NTMs on extensive and intensive margins of seafood exports at various levels of aggregation. The main result of this study is the differential effect of SPS and TBT measures. While SPS measures largely influence the production fixed costs and the variable trade costs, increasing extensive margins of export and reducing intensive margins, TBTs mostly increase fixed exporting trade costs, reducing exports at extensive margins and increasing exports at intensive margins. We also find that STCs have larger effect on exports than SPS and TBT notifications economically and statistically – STCs are mostly raised by exporters when their trade is considerably affected by regulations. Finally, there is substantial heterogeneity of response of exports to NTBs across product lines for higher disaggregated data. This finding implies that in order to estimate an effect of the NTM policy change on exports, both type of NTM and market structure should be taken into account.

An important issue of NTM endogeneity – political economy concerns of trade policy that depends on the importance of large domestic producers in defining trade policy in importing countries -- is not fully resolved. We leave this issue for further analysis.

References

Anders and Caswell (2009)

Anderson, J. E., & van Wincoop, E. (2003). Gravity with Gravitas: A Solution to the Border Puzzle. *American Economic Review*, 93(1), 170-92.

Baier, S. L., & Bergstrand, J. H. (2009). *Bonus vetus* OLS: A simple method for approximating international trade-cost effects using the gravity equation. *Journal of International Economics*, *77*(1), 77-85.

Crivelli, P., & Gröschl, J. (2012). SPS measures and trade: Implementation matters. *Staff working paper ERSD*, No. 2012-05

Debaere, P. (2010). Small fish–big issues: the effect of trade policy on the global shrimp market. World Trade Review, 9(2), 353

Djankov, S., Freund, C., & Pham, C. S. (2010). Trading on time. *The Review of Economics and Statistics*, *92*(1), 166-173.

Fontagné, L., Mondher, M., & Pasteels, J. (2005). Estimating The Impact of Environmental SPS and TBT on International Trade. *Integration and Trade Journal*, 22(3): 7–37.

Hausman, J. A., & Taylor, W. E. (1981). Panel data and unobservable individual effects. *Econometrica*, *49*(6), 1377-1398.

Head, K., Mayer, T., & Ries, J. (2010). The erosion of colonial trade linkages after independence. Journal of International Economics, 81(1), 1-14.

Helpman, E., Melitz, M., & Rubinstein, Y. (2008). Estimating trade flows: Trading partners and trading volumes. *The Quarterly Journal of Economics*, *123*(2), 441-487.

Jaffee, S., & Henson., S. (2004). Standards and Agro-Food Exports from Developing Countries: Rebalancing the Debate." Policy Research Working Paper 3348, The World Bank, Washington, DC.

Melitz, M. J. (2003). The impact of trade on intra-industry reallocations and aggregate industry productivity. *Econometrica*, *71*(6), 1695-1725.

Otsuki, T., Wilson, J.S., & Sewadeh, M. (2001). Saving Two in a Billion: Quantifying the Trade Effect of European Food Safety Standards on African Exports. *Food Policy*, 26:495–514.

Peterson, E.B., & Orden, D. (2005). Effects of Tariffs and Sanitary Barriers on High- and Low- Value Poultry Trade. *Journal of Agricultural and Resource Economics,* 30(1):109–27.

Shepotylo, O. (2010). A Gravity Model of Net Benefits of EU Membership: The Case of Ukraine. *Journal of Economic Integration*, *25*(4), 676-702.

Wooldridge, J. M. (2005). Simple solutions to the initial conditions problem in dynamic, nonlinear panel data models with unobserved heterogeneity. Journal of applied econometrics, 20(1), 39-54.

World Trade Report 2012: Trade and Public Policies, a Closer Look at Non-Tariff Measures in the 21st Century, Research and Analysis. World Trade Organization, 2012

Results at 6 digit

	1st stage Probit					2nd stage Hausman-Taylor				
HS 6 digit	**SPS**	**TBT**	**STC**	**Pseudo R^2**	**N**	**SPS**	**TBT**	**STC**	**Chi^2**	**N**
30110	0.056***	-0.017	0.43***	0.62	281574	-0.020	-0.028	-0.44***	6912.9	13746
30191	0.11**	0.13*	0.36***	0.53	131623	-0.11	-0.051	-0.14	859.9	1818
30192	0.043	0.033	0.52***	0.59	80710	0.029	0.20	0.14	576.9	2360
30193	0.035	0.056	0.38***	0.57	88698	0.082	-0.47	-1.49	1688.0	1728
30199	0.0045	0.065	0.78***	0.51	285402	0.045	0.12	0.26	3308.1	6407
30211	0.10***	0.11*	0.37***	0.57	196676	0.11	-0.32	-1.16*	2848.2	4021
30212	0.11***	-0.078	0.50***	0.64	180361	-0.059	-0.088	0.37	4183.1	5863
30219	0.057*	0.050	0.40***	0.50	260486	-0.52*	0.46	-0.61	2826.7	4156
30221	0.16***	-0.061	0.45***	0.60	91271	0.13	-0.57	0.26	2062.3	2473
30222	0.22***	-0.083	0.26*	0.64	77154	-0.30	-0.43	0.85	1437.3	2029
30223	0.15***	0.037	0.18	0.63	106626	-0.27	-0.40	-0.12	2182.7	2848
30229	0.053*	0.026	0.48***	0.59	232594	0.081	0.36	-1.04*	2334.4	4642
30231	0.14***	0.0069	0.42***	0.50	139910	0.20	-0.26	-0.54	1529.7	1890
30232	0.13***	0.035	0.52***	0.51	160712	-0.12	0.99*	-1.31***	1201.0	3097
30233	0.072	-0.0064	0.18	0.50	65181	0.34	-1.18	0.79	644.8	875
30239	0.073**	0.057	0.49***	0.52	234665	0.16	0.77***	-0.52	1962.5	4416
30240	0.16***	0.032	0.14	0.54	102172	0.17	-0.37	0.14	620.3	1989
30250	0.21***	-0.028	0.38***	0.61	121917	-0.29	-0.58	0.33	2664.8	3626
30261	0.071*	-0.043	0.25**	0.54	186297	0.15	0.97*	-0.45	785.4	2637
30262	0.30***	-0.0029	-0.16	0.65	58295	-0.50	-0.030	0.62	514.4	1414
30263	0.28***	-0.092	0.15	0.64	49012	-0.18	-0.54	0.95	558.9	1499
30264	0.18***	-0.0075	0.27**	0.55	165571	0.0011	-0.37	0.96	1984.7	3104
30265	0.15***	-0.012	0.34***	0.62	101654	-0.53***	-0.93*	-0.060	1226.5	2174
30266	0.15***	-0.086	0.18	0.57	67857	-0.33	0.12	-0.86	1555.5	1474
30269	0.054***	-0.015	0.62***	0.57	338840	-0.19	0.16	-0.41*	9777.9	13889
30270	0.12***	-0.012	0.34***	0.51	177807	-0.016	0.23	-0.38	727.4	3120
30310	0.066**	0.039	0.58***	0.48	262814	0.060	0.18	-0.043	2059.2	5804
30321	0.024	-0.039	0.011	0.54	196670	-0.18	0.010	-0.40	2509.3	4236
30322	0.044	-0.080	0.10	0.56	159668	-0.29**	-0.047	-1.24	6184.2	4665
30329	-0.023	-0.024	0.47***	0.44	255420	-0.13	-0.013	-0.34	2017.6	4491
30331	0.033	-0.18**	0.30**	0.56	96305	0.0035	-0.51	0.16	2002.7	2984
30332	0.081*	0.10	0.28**	0.49	87686	-0.053	0.46	-0.32	1294.6	1634
30333	0.088**	0.044	0.059	0.53	174528	-0.0068	0.67*	0.71	1285.0	3007
30339	0.0096	-0.061	0.61***	0.49	257470	-0.033	0.51	0.37	4584.9	5282
30341	0.070*	-0.14**	0.32***	0.44	149507	-0.13	0.079	0.28	1198.9	2242
30342	0.044	-0.13**	0.19**	0.47	165910	-0.044	0.10	-0.69	1956.4	3783
30343	-0.019	-0.17**	0.23*	0.44	101591	0.032	0.90	-0.53	1310.1	1935
30349	0.033	-0.092*	0.37***	0.44	242785	0.20	-0.14	-0.70	2388.8	4406
30350	0.019	0.092	0.31***	0.54	131383	-0.20*	0.16	0.23	1594.4	4278
30360	0.081**	-0.18***	0.36***	0.51	152105	-0.060	-0.14	-0.074	1374.6	3941

	1st stage Probit					2nd stage Hausman-Taylor				
HS 6 digit	**SPS**	**TBT**	**STC**	**Pseudo R^2**	**N**	**SPS**	**TBT**	**STC**	**Chi^2**	**N**
30371	0.054*	0.083*	0.12	0.51	223926	0.024	0.22	0.54*	3169.1	6267
30372	0.0016	-0.065	0.077	0.45	59258	0.33	-0.073	0.28	763.6	1196
30373	0.022	-0.0043	0.51***	0.47	83292	-0.079	-0.30	0.97	1351.5	1421
30374	0.029	-0.019	0.41***	0.51	224506	0.21*	-0.20	0.27	4503.3	9203
30375	0.049	-0.13**	0.34***	0.51	175264	0.10	0.77**	0.11	3383.8	3833
30376	0.056	-0.14*	0.52***	0.51	101052	0.0079	-0.47	-0.18	679.0	2009
30377	0.010	-0.069	0.12	0.48	113496	-0.070	-0.20	0.41	1652.4	1795
30378	0.13***	-0.052	0.54***	0.53	159877	-0.23	-0.12	0.21	3963.5	4953
30379	-0.0069	-0.080**	0.45***	0.54	341670	0.024	0.26*	-0.0085	10953.2	23105
30380	0.074**	-0.089*	0.49***	0.53	188257	-0.14	-0.22	-0.31	2073.0	5319
30410	0.11***	-0.027	0.61***	0.55	313235	-0.064	0.19	-0.41	4700.9	12582
30420	0.059***	-0.076**	0.65***	0.58	312794	0.12*	-0.078	-0.40**	4785.0	22707
30490	0.084***	-0.025	0.62***	0.54	307378	-0.11	-0.14	-0.30*	7052.4	13228
30510	0.0016	0.047	0.48***	0.45	237377	-0.079	-0.14	-0.22	1009.0	3229
30520	0.046	0.13**	0.57***	0.50	202536	0.046	0.42*	0.11	1737.7	3848
30530	0.023	0.095*	0.21**	0.52	264072	-0.14	0.25	0.20	1379.2	6134
30541	0.011	0.093*	0.071	0.62	217817	-0.11	-0.15	0.33	2858.3	9256
30542	0.048	0.17**	-0.12	0.57	124217	-0.18	0.40	0.23	2372.0	2585
30549	0.017	0.14***	0.10	0.54	289982	0.056	-0.25	-0.94**	2969.5	8590
30551	0.0049	0.036	0.22*	0.56	177688	0.039	-0.18	0.82	1137.3	3454
30559	-0.071***	0.073*	0.19**	0.54	306728	-0.18*	-0.071	0.16	1096.9	9828
30561	0.051	0.13	0.091	0.53	121699	0.081	0.15	-0.90	807.5	2064
30562	0.066	-0.14	0.41***	0.57	68879	0.16	0.23	-0.57	658.6	2031
30563	0.044	0.10	0.31**	0.53	102232	-0.28	0.33	0.017	1539.9	1872
30569	-0.012	0.040	0.41***	0.50	291861	0.11	-0.13	0.51	1255.9	5754
30611	0.059**	-0.091*	0.59***	0.48	236804	-0.38**	-0.20	-0.71*	2553.4	4961
30612	0.053*	-0.0060	0.60***	0.53	191745	-0.10	0.13	-0.36	1591.4	4893
30613	0.052***	-0.10***	0.36***	0.55	302278	-0.22**	0.23	-0.29*	26011.8	18152
30614	0.10***	-0.044	0.54***	0.57	257810	-0.027	0.33	-0.029	4126.3	8012
30619	0.067***	-0.00050	0.43***	0.53	253264	-0.077	-0.098	-1.04*	2187.1	6291
30621	0.040	-0.20***	0.43***	0.54	156232	-0.16	0.13	-0.052	1386.4	3031
30622	0.038	-0.13**	0.69***	0.57	160793	-0.19	-0.13	-0.11	1422.6	4478
30623	0.071***	-0.050	0.44***	0.54	275562	-0.23*	0.071	-0.14	2291.4	7302
30624	0.043	-0.13**	0.38***	0.56	198407	-0.22	0.58	0.25	4200.8	5024
30629	0.047*	0.046	0.53***	0.54	237087	-0.20*	-0.11	0.53	1236.3	5489
30710	0.0018	-0.13*	0.59***	0.59	200264	0.17	-0.10	-0.63*	2002.6	5233
30721	0.068*	-0.096	0.54***	0.56	136284	-0.18	0.074	-1.15***	3272.0	3630
30729	0.036	-0.023	0.39***	0.57	214764	-0.051	-0.35*	-0.48*	7400.7	7361
30731	0.100***	-0.066	0.17	0.59	145384	-0.013	0.0085	-0.97	2200.2	3549
30739	0.062**	-0.017	0.084	0.56	248642	-0.016	-0.027	-0.20	5196.4	6415

	1st stage Probit					2nd stage Hausman-Taylor				
HS 6 digit	**SPS**	**TBT**	**STC**	**Pseudo R^2**	**N**	**SPS**	**TBT**	**STC**	**Chi^2**	**N**
30741	0.12***	-0.065	0.29***	0.54	218573	-0.20	-0.088	-0.19	2009.9	4785
30749	0.081***	-0.12***	0.33***	0.57	278928	0.095	0.045	-0.083	5775.2	13293
30751	0.20***	-0.076	0.19	0.53	133596	-0.30	1.18*	-1.81	1254.6	2481
30759	0.14***	-0.091*	0.45***	0.55	224266	0.010	-0.050	0.29	5266.4	7678
30760	0.055*	-0.012	0.53***	0.54	173188	-0.27	0.094	-0.050	1200.8	3413
30791	0.051*	-0.11*	0.57***	0.54	216933	-0.25	0.13	-0.17	2150.8	4778
30799	-0.025	-0.054	0.62***	0.56	284304	-0.13	0.20	-0.031	9317.0	11058
160300	0.11***	-0.028	-0.30	0.59	213118	0.0061	0.075	-0.12	3726.8	6813
160411	0.10***	0.025	-0.093	0.57	223348	-0.035	-0.10	-0.28	1994.6	7726
160412	0.084**	0.040	-0.032	0.60	183278	0.080	0.13	-1.16***	2353.7	7039
160413	0.0061	0.032	0.91***	0.56	297876	0.052	0.00099	-1.18*	4610.1	14089
160414	0.16***	-0.032	0.95***	0.53	271138	0.052	0.070	-0.51	4165.9	14646
160415	0.081***	0.040	0.19	0.52	214196	0.015	-0.075	-0.34	20680.5	8896
160416	0.066*	0.043	0.17	0.59	167988	0.086	0.12	0.48	3176.6	5497
160419	0.073***	-0.012	0.22	0.57	271828	-0.15	0.042	-0.39	5153.3	13064
160420	0.090***	0.0036	0.46***	0.58	298118	-0.082	0.038	-0.71	12407.3	19910
160430	0.075**	0.021	0.24	0.61	204512	-0.20*	-0.019	-0.023	4974.9	8690
160510	0.13***	0.021	0.064	0.56	201886	-0.077	-0.042	-0.41	1855.9	6440
160520	0.13***	-0.032	0.50***	0.58	230256	0.099	0.036	-0.92	5040.3	11083
160530	0.18***	0.0026	-0.14	0.52	112731	-0.14	0.033	-0.61	1704.2	2251
160540	0.21***	-0.0094	0.71***	0.55	162082	-0.0065	0.33**	0.32	5466.5	4634
160590	0.051**	-0.0034	0.32*	0.60	274414	-0.059	0.043	0.041	4685.4	14171

Dependent variable in the first stage model is an indicator whether export from country i to country j in product k at time t is positive or not. The model is estimated by probit, taking into account the panel component as suggested by Wooldridge (2005) Standard errors in parentheses. Time fixed effects are included but not reported. Dependent variable in the second stage model is export from country i to country j of product k at time t. The model is estimated by Hausman-Taylor method, treating SPS, TPT, and STC measures as endogenous. Time fixed effects are included but not reported. Bootstrap standard errors in parentheses.

* p<0.05, ** p<0.01, *** p<0.001

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